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NOTICE.

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CONDITIONS OF FORESTRY IN CALIFORNIA.

By ABBOT KINNEY, Lamanda, Cal.

[Read at World's Fair Congress, October, 1893.]

The condition of forestry in California is as good as a bad thing can be. The Federal Government has at last taken the preliminary steps looking to a national forestry system by reserving from sale important districts of mountain forest lands.

These forest reservations in California are large and well selected. They cover the main sources of water supply for the large irrigation interests of the State, and also those mountains from which torrents now flow and from which new torrents would originate were the forest covering removed. There is, however, as yet, no management of these forest reservations whatever, and no protection, except in the addition to the Yosemite Park.

This exceptional protection has been effective by means of a troop of United States cavalry, by which the Yosemite Park has been patrolled.

The success and efficiency of this protection shows what can be done, and should be extended to the other reservations pending the establishment of a forestry system.

The necessity of some action of this kind is shown by a recent report to me from one of the special land agents. This gentleman states that through one of the entrances to the Sequoia Reservation some 300,000 head of sheep passed in this summer, and that the entire forest, as far as he saw it, was like a dusty road from the effects of this invasion. It is probable that nearly 1,000,000 sheep have been on this reservation this summer.

Forests and sheep are things incompatible, but, in view of the extent of the sheep interests, the using of the California mountain pastures should impress upon us the necessity of a careful and conservative policy in ending this source of injury to our forests.

The State Board of Forestry has been discontinued and its stations turned over to the University of California. This is not a serious loss, for the only effective forest policy is a national one. The State executive system is not sufficiently concentrated to carry on effectively a work of this kind, and, besides this, forest interests

are not separated by State lines, and no harmonious or efficient system could be expected from the independent action of the different States.

We look forward with much hope to the creation of a practical forest system for the government of all the national forest lands.

THE FOREST CONDITIONS IN THE GULF STATES.

By Dr. CHARLES MOHR, Mobile, Ala.

[Read at World's Fair Congress, October, 1893.]

The Gulf region, as considered here, comprises that part of the Atlantic forest division which extends from the Chattahoochee and Apalachicola rivers through the States fronting the Gulf of Mexico, to the treeless plains of Texas. With the exception of the mountainous part, on its northeastern limits, this region can be regarded as a vast plain with a gentle decline from north to south to the seashore, originally almost completely covered with forest; pines and other evergreens predominating in its southern half. Little less than 50 per cent. of its area is still in woodlands, and by far the larger proportion in their original condition.

The most prominent feature of the Gulf region is presented by the great coast pine belt, with its forests of long-leaf pine, which, east of the Mississippi river, extends from the Atlantic slope to the bluffs bordering the alluvial region of this river, with an average width of 125 miles. This eastern coast pine belt covers, roughly estimated, 38,000 square miles. West of the Mississippi river the forest of long-leaf pine reappears upon the deposits of sands and pebbles, of a more recent geological formation, which rise above the lowlands of the Atlantic coast region and the eastern Gulf coast. These western forests of long-leaf pine extend but a short distance below the 31st degree of latitude, and cover an area of between eleven or twelve thousand square miles, nearly equally divided between Louisiana and Texas.

East of the Mississippi river, on the coast plain, the low sandy shores of the Gulf, the headlands and outlying islands above the tide are chiefly covered by the Cuban pine, this tree following the

inlets of the sea and the borders of the swamp lining the water-courses for a distance of almost fifty miles from the seashore. The broad low clay ridges rising above the tide-water swamps were originally heavily timbered with long-leaf pine, associated on their declivities with the loblolly pine. On the extensive flats with their sterile and ill-drained soil, the low pine barrens or so-called "pine meadows," the long-leaf pine is more scattered and the trees of a somewhat stunted growth. In the hummock lands which cover the fertile damp depressions between these ridges the fine live oaks have, to a great extent, disappeared.

The heavier timber growth of the long-leaf pine in the coast plain has been removed. On the better class of pine lands in many localities it has been succeeded by the Cuban pine, yet a second growth of the long-leaf pine is frequently seen to have taken possession of the ground. However promising the second growth appears, it is frequently found more or less injured by the tramping of live-stock and scarcely escapes destruction by fire. These ridge-lands, susceptible of much improvement under cultivation, will, sooner or later, be subjected to the plowshare.

In the flat woods, unsuited for tillage, the renewal of the long-leaf pine finds a great obstacle on account of the seedlings, which happen to start in the fall, being killed by the water which covers these areas for the greater part of the cool season.

The alluvial lands of the rivers and their deltas, subjected to almost perpetual overflow, are covered with dense forests of black gum, water oaks, cottonwood, green ash, and, where the alluvial soil is of greatest depth, tupelo gum and cypress (*Taxodium distichum*) flourish.

In the extensive swamps on the Apalachicola river, among the dense growth of ogeche lime (*Nyssa capitata*), cypress of large dimensions are found which have circumferences of from 12 to over 18 feet above the buttresses of the trunks forming their base, and from 60 to 75 feet in height before spreading out their umbrella-shaped crown. Trees of smaller size are rarely met with and none of second growth have been observed on the older clearings of these swamps. The timber when freshly felled is apt to sink in water; therefore, the trees are deadened by girdling during the summer, and the dead trees are felled the following year, at the time of freshets.

The timber is rafted to Apalachicola, where from 10,000,000 to 12,000,000 are cut annually. In the delta of Mobile river and the

swamps along the lower Tombigbee and Alabama rivers the best of the cypress timber has been culled. From the supplies which reach the shingle mills at Mobile, with an output of 175,000,000 pieces a year (1891), it is evident that the resources of this section are far from being exhausted. The cypress forests existing in other parts of the Gulf region may, in this connection, be spoken of. In the western Gulf region this tree is found most abundant in the swamps and shallow lakes of the Mississippi and Yazoo bottom. In the latter the cypress forms brakes, the gigantic trunks rising above the dark, placid water, from among the strange, cone-like, bald excrescences sent up from their roots to a height from 2 to over 5 feet.

Any attempt to form an estimate of the timber wealth hidden in these swamps and brakes scattered among the 4,000,000 acres of dense forest covering this delta region proves futile. Without an outlet, it has until recently been practically inaccessible. It is only during the past year or two that it is being made available by the railroad lines built through this section. The greater part of Southern Louisiana is covered with cypress swamps; between Lake Ponchartrain and the waters that find their outlet by the Atchafalago river about 1,500,000 acres, more or less, are covered with cypress. Even with the meagre information obtained, it appears that 175,000,000 feet b. m. of cypress lumber and 475,000,000 of shingles are at the present time annually produced in this alluvial region. Under the increasing demand for cypress lumber, which every year is becoming more appreciated, the cypress lands are speedily passing under the control of capital.

In all probability there will, in the future, be neither room nor time allotted for reforestation upon these lands, which are unsurpassed in fertility, if reclaimed and protected from the periodically recurring floods of the Mississippi river.

In the sphagnous swamps lining the pine-barren streams in the lower section of the pine belt, the white cedar or juniper (*Chamæcyparis thyoides*) forms a conspicuous part of the tree growth, the timber of which, having a value equal to that of red cedar, is consequently in great demand; the supplies existing in Alabama and Mississippi are rapidly dwindling away, and the better grades have been already culled.

In the rolling pine lands or pine hills of the eastern Gulf region, rising to an elevation from 150 to 250 feet above the coast plain, the long-leaf pine holds undisputed sway. The wide table-lands,

between the watercourses, broken into low, rounded hills near the waterways, are, without interruption, covered with forests exclusively of long-leaf pine. These forests are open, and almost without any undergrowth; the lightly shaded ground beneath the tall pines is covered with a carpet of various grasses and herbs, principally of the leguminous order and the composite family. According to official returns obtained at the ports of export, not less than 715,000,000 f. b. m. of hewn and sawn square timber and lumber have been shipped annually from the ports in Western Florida, Alabama, and Mississippi and inland by rail during the past few years. Traversed by numerous streams permitting the rafting of the logs to the mill sites, offering in its topographical and soil conditions the best opportunities possible for the construction of tramways to the highways of communication by rail to inland markets, or by water to the sea-ports with their fine harbors and safe roadsteads, this lower section possesses unrivalled advantages, which stamp it at once as one of the principal centres of the lumbering interests of the Southern States.

With the appearance of the calcareous rocks and marls of the older tertiary strata in the upper part of this eastern pine belt the country becomes more broken. With this change in the topographical and soil condition, the forest growth also undergoes a change. Deciduous trees, mostly oaks, hickory, and broad-leaved evergreens, share the ground with the pines. The short-leaf pine is found among the upland oaks, post, black and Spanish oak, and pig and bitternut hickory. The forests of white oak, shellbark and mockernut hickory, ash, beech, magnolias, red cedar, which covered the rich black lands, the so-called prairie lands, in this upper section, have for the greatest part given place to the cotton-field. The area of this division is estimated to extend into Alabama and the adjoining section of Mississippi over 10,000 square miles, and it can be said that fully one-half of the area is covered with long-leaf pine. The timber growth in these pine forests is heavy, and in many localities it has been found to amount to double the quantity found upon a corresponding area in the forests of the lower section of the pine belt. The steep ridges and the greater distance from navigable streams render the transportation of the timber to the mills more costly than in the forests further south, and the consequence of which is that the forests on these hills have been much less encroached upon.

The forests of long-leaf pine on the belt of sands and gravels

which cross Alabama almost centrally from east to west, from 5 to 25 miles in width, do not differ materially in their conditions from those of the lower pine belts. In the basin of the Coosa river the forests of long-leaf pine on the drifted deposits of the valleys furnish timber of excellent quality, and about 25,000,000 feet are shipped annually from Gadsden. In this region the long-leaf pine is found to ascend the mountains to a height of almost 1,000 feet above the sea. The forests on the barren rocky heights of sandstone are very open and the timber of inferior size. The same is to be said of the long-leaf pine on the mountain ranges in the metamorphic region of Alabama, where this tree is found thinly scattered on the highly silicious, rocky soil and considered commercially of no importance. West of the Mississippi river, in the basin of the Red River in Louisiana, the rolling uplands are covered with the forests of the long-leaf pine. Between the broad low hills numerous streams wind their course to the alluvial region, their fertile bottoms timbered with white oak, red oak, black gums, and magnolias. The pine forests are rather open, finely timbered, and, in their general condition, not differing from the forests on the pine hills in lower part of the west pine belt east. Before the opening of the Houston Central & North Arkansas Railway lately, this finely timbered region had remained almost intact. During the past year (1892) the output of the mills along the railroad reached fully 75,000,000 f. b. m. In the area drained by the Calcasieu and the Sabine rivers in their lower course, and in Texas by the Neches river, the forests of long-leaf pine extend, with scarcely any interruption, over a vast, almost perfectly level plain, becoming somewhat undulating only near the watercourses. Their soil of rather impervious silt is water-soaked for the greater part of the year. The timber growth on these "pine flats" is in general found denser than on the rolling land, and the trees are taller. By the owners of these timber lands the merchantable timber standing upon one acre is assumed to average from 6,000 to 7,000 feet, including all sound trees between 11 to 12 inches in diameter. In furnishing the timber supplies for the large mills at Lake Charles, La., Orange and Beaumont, in Texas, and the numerous smaller mills on the Sabine and Texas Railroad, logging is carried on with great activity. In the extensive pine flats steam-equipped tram-roads penetrate the forest for a distance of 12 to 20 miles; east of the Sabine river lateral tracts are laid through the middle of the sections, which are almost completely stripped of their tree growth. Quoting the in-

formation obtained from leading firms engaged in the business, the output of the mills depending for their timber supply on these flat woods appears to have been during the year 1891 fully 700,000,000 feet b. m.

Adding to this output the cut on the pine hills north of the Red River, the amount of lumber produced in the forests of long-leaf pine west of the Mississippi during the same year falls little short of 800,000,000 f. b. m.

The forests of the rolling country, rising above the pine flats in the upper part of Calcasieu parish, according to information obtained, are in about the same condition as those found on the pine hills north of the Red River. On account of their inaccessibility and the distance from the Northern markets, they have remained almost untouched by the lumberman's axe.

Turpentine orcharding, which caused the devastation of millions of acres of long-leaf pine forest, is in the Gulf region confined within its eastern part. It can safely be maintained that the aggregate production of the 361,320 casks (of 50 gallons each) of spirits of turpentine for the period of eleven years, including the year 1880 to the close of 1891, reported as received in the Mobile market, has involved the utter devastation of not less than 2,250,000 acres of timber land. Under the present system of management the bled timber from the abandoned turpentine orchards of former years is speedily disappearing. Conveniently located along the railroad lines and rivers, they are being rapidly cleared. Of late years turpentine orcharding is brought in immediate connection with the lumbering business, and this practice will receive a powerful stimulus, since it has been demonstrated by the U. S. timber tests that the timber is found in no way impaired in its physical qualities by the bleeding. There can be no doubt that in the near future the forests will invariably be worked for their resinous products immediately before the timber is to be felled for the saw-mill.

For the spontaneous renewal of the long-leaf pine in the Gulf region there appears to be no hope under the existing management. Carried on under the high pressure of large investments of capital in large manufacturing plants, with a daily output all the way from 60,000 to 100,000 f. b. m., the supplies transferred from the forests to the mill by costly steam-power and in connection with the modern dry kiln, permitting the sappy stuff of lower grades to be turned into a merchantable article, the forests are almost completely cleared of their tree growth. The scanty remainder, if bled

for turpentine, is laid low by storms or destroyed by fire, and, even in districts where it has not been subjected to this infliction, amounts to little as a factor of future increase. The second growth of the long-leaf pine on the denuded areas, exposed to the periodically returning fires, which, east of the Mississippi, originate in connection with turpentine orcharding, and elsewhere from accident, carelessness, or design, is doomed to destruction. Although the flat woods are less liable to this danger, the renewal of the forest by natural seeding is here rarely found to take place, the cold soil, soaked with water for the greater part of the season, being as unfavorable to the germination of the seed as it is to the growth of the seedling. The flat woods, stripped of their timber during the past twenty-five years, are overgrown with tall broom-sedge grass (*Andropogon virginicus*), and present mostly the aspect of savannas, almost, if not entirely, destitute of trees.

In regard to the remaining supplies of merchantable long-leaf pine timber in the Gulf States, opinions differ widely, and the attempts to estimate for the 10th Census the quantity still existing have evoked severe criticism. The discrepancies find their explanation in the differences of the understanding as to what is considered as merchantable timber.

There must necessarily appear a wide difference between the statements based on a standard which considers solely the higher grades, as was then done, and those made upon the present low standard, which includes every stick with a diameter as low as 10 to 11 inches.

In 1880, only timber squaring 12 inches at the top, free from sap, and without blemish, was considered by lumbermen merchantable; such quality, first cull, formed about one-fifth to one-fourth of the timber growth that would at present be used for milling. This standard of merchantable timber was taken for the basis in the estimates of the merchantable timber standing in 1880, and on a broad average the estimate of 3,000 feet per acre was arrived at, which at that time was considered, by those conversant with such matters, as a fair approximation. If, however, as is the usage at the present time, the total of the timber standing down to that of the low dimensions indicated is taken into consideration in the estimate for the same area, it cannot fail to show widely differing results, namely, from 50 to 70 per cent. of larger yield. With the introduction of the steam-equipped tramway, reducing cost of transportation of the lumber to the mill, and the dry kiln of the present day, low grades

of timber can be profitably converted into merchantable stuff which now find a ready demand in distant markets, while formerly it could not have been disposed of.

In the Gulf region west of the Mississippi, the short-leaf pine is widely distributed, and found in great abundance and perfection of growth. The extensive forests of this species north of the long-leaf pine belt in Louisiana and Texas, extending west to the prairie region of the latter State, are, in the vastness and value of their resources, almost equal to the forests of long-leaf pine adjoining them on the south. In the wide upland region of Northern Louisiana the forests, purely of short-leaf pine, are confined to the ridges of a poorer soil, while on the lands of better soil this pine is associated with upland oaks and hickory.

For want of proper transportation facilities to distant markets the forests in this section have been scarcely touched. In the adjoining part of Texas, forests almost exclusively of short-leaf pine cover areas of many hundreds of square miles in extent. Their timber growth is of fine quality; upland oaks mostly form the undergrowth. In the extensive forests between Texarkana and the town of Marshall the lumbering industry is carried on with the same relentless activity as in the coast pine belt, and the forests are as closely stripped. In the year 1891 about 300,000,000 f. b. m. were shipped by rail to the markets of the Northwest.

By the facilities of dissemination inherent to this species, the spontaneous renewal of the forests is more readily effected than in the case of the long-leaf pine; it is also still further favored by the greater rapidity of its growth. From all appearances the second growth is less liable to destruction by fire on the more retentive soil of the uplands; particularly in the more populated districts groves of second growth of varying age are frequently met with, giving great promise for the future. In the central and the eastern section of Northern Mississippi, and in Alabama, the abandoned fields are soon overgrown with young pines of thrifty growth. It is evident that this pine is destined to play an important part in the forestry of the Gulf region in the future.

The hard-wood forests in the region of mixed growth and in the great agricultural region of Central Alabama, Central and Eastern Mississippi have for the greatest part disappeared on the fertile uplands and arable bottom lands. At present they are confined to the hills of a poorer soil, to the remoter valleys, and to the unreclaimed alluvial lands. In such situations tracts covered with

their original forest growth are existing, with supplies of valuable timber to meet the wants of a future generation. On the uplands they consist of white oak, post oak, black and Spanish oak, mockernut and butternut, and hickory, interspersed with short-leaf pine, and in the lowlands of swamp white oak, overcup oak, red oak, red gum, ash, shellbark hickory, beech, magnolia, and more sparingly of tulip trees. From the lower valley of the Tombigbee river in Alabama, its headwaters in Mississippi, and from the lower Alabama river and its tributaries considerable quantities of oak, ash, and gum reach Mobile. North of the central belt in Alabama the white oak is the most important feature of the hard-wood forests in the valleys, where the tulip tree is also found frequently associated with this tree. The rugged hills of carboniferous slabs and sandstone are under cover of an inferior growth of upland oaks and hickory. These forests, limited as they appear in the resources of timber of a more valuable kind, are of no little importance to the rapidly developed mining interests of this mineral region of the State, which already cause a heavy draft upon them. In the valleys of the mountain region further north, forests of swamp white oak and tulip trees, with all the other valuable kinds of timber characteristic of the lowlands, are found in quantities to insure large supplies for the near future. The black walnut, at one time not uncommon, is at present only found hidden in the most inaccessible recesses. The 6,000 square miles of the elevated table-land of the Warrior coal basin were a quarter of a century ago an unbroken forest wilderness. The short-leaf pine largely prevails on the thinner soils of the steeper ridges, with post oak, black oak, Spanish oak, mockernut, hickory, and chestnut, the deciduous trees becoming more frequent as the soil conditions improve. At an elevation of about 1,000 feet above sea-level the mountain or tan-bark oak (*Quercus prinus*) becomes one of the most prominent trees on these uplands. White oak of fine proportions is not uncommonly found upon the spots with an accumulation of a deeper, richer soil. In the shallow depressions or swales, destitute of drainage, the loblolly pine arrives at great perfection. In such localities, from 15,000 to 20,000 feet of merchantable timber have been estimated to the acre on smaller areas. The finest forests of hard-wood timber in Alabama are found in the coves which sweep along the base of the mountain ranges bordering the southern side of the valley of the Tennessee river, and in the secluded valleys enclosed by the detached

spurs of the Cumberland mountains north of the river. On the benches of these coves, white oak, Spanish oak, red oak, black oak, with shellbark hickory, are found in abundance and of most perfect growth. The swamp white oak, red oak, willow oak, and ash abound in the broad valley. Considerable quantities of these hard woods are sawn at Decatur and at the smaller mills located on the Memphis and Charleston railroad north of the river. It is claimed that in the remoter valleys in the northeastern part of this river basin the tulip tree is found in quantities equal to any that is found in the most favored districts of the southern Appalachian region. On the outcrops of the mountain limestone, forming the lower flanks of the mountains north and south of the Tennessee river, are found glades of red cedar; on the dry and rocky declivities the timber is knotty, but of late it has become highly prized for telegraph poles, piling, and posts. Timber of finer qualities is found in the damp, narrow valleys among the hard-wood timber growth; red cedar of higher grades, which is eagerly sought for for the manufacture of lead pencils, hollow ware, and cabinet work, is becoming scarce. With their impending exhaustion the cedar glades, formerly frequently damaged by fires, are now being carefully guarded against such accident. What has been said about the forests of deciduous-leaved trees in Central Alabama and in Mississippi applies to the uplands of Northern Louisiana. The upland forests in the more densely populated districts of these States, particularly if in close connection with the farms, have greatly suffered by the heedless devastation of their resources, and by their use for pasture grounds during the entire year, causing their speedy deterioration and eventual destruction. The greatest damage, however, results from the injudicious clearing of the hill-sides for the sake of raising a few crops, which is sooner or later found to be unprofitable, and the land is then abandoned. The subsequent washing away of the soil renders the renewal of the timber growth of any value an impossibility.

The most extensive body of hard-wood forest in its primeval condition on this part of the continent, and unsurpassed in the variety and quality of its timber wealth, is found in the Mississippi and Yazoo bottom, extending over 4,000,000 acres in 1880. With its huge red gums, swamp white oaks, red maples, overcup oak, red and willow oak, sassafras, honey locust, pecan, mockernuts, and cotton-wood of gigantic dimensions, its resources appear truly astounding. Black walnut is not uncommonly found on the higher swells of the

ground, and at Indian Bayou in 1880 it was still cut for fencing. These stupendous resources are now being made available by the railroads lately constructed in this delta. On the western bank of the Mississippi river, in East Carroll and Madison parish, in Louisiana, the same conditions prevail with the forests rising above the cypress swamps, the pecan being found more frequently in the western lowlands; large tracts of forest of similar conditions prevail in the valley of the Red river through its extent in Eastern Texas. The hard-wood timber forests west of the eastern timber region of this State, being generally confined to narrow strips skirting the streams, are commercially of little importance. The bottoms of the valleys of the upper Trinity, the lower Brazos, Colorado, and of the Guadeloupe rivers are, however, finely timbered with red oak, pecan, the southern pin oak (*Quercus durandii*) and Texan elm (*Ulmus crassifolia*). The bois d'arc or Osage orange is, in the Gulf region, mostly confined to the upper Trinity valley. The red cedar at one time abundant in the Brazos valley has almost disappeared. The western cedar (*Juniperus occidentalis* var. *conjugens*) is found scattered in numerous clumps over the calcareous highlands around the headwaters of the Guadeloupe river. These cedar glades have been much damaged by the conflagrations to which they have been exposed from time to time.

The two narrow belts of open woods, known as the cross-timbers, which extend from north to south through the bare plains of Western Texas, are covered with black jack, blue jack, or upland willow oak and post oak of inferior size. With the copses of mesquit (*Prosopis juliflora*) which in some localities are scattered over the plain, they are of importance as a source of fuel in the otherwise treeless region of the far Southwest.

Such are the forest conditions of this part of the country, a rational exploitation of which with regard to the future is as little or less to be expected at present as in most other sections of the United States.

FORESTRY IN NEW SOUTH WALES, AUSTRALIA.

By Robert Hudson, Esq., General Superintendent of New South Wales Exhibits, W. C. E.

[Read at World's Fair Congress, Oct., 1893.]

The sea-coast and rivers of New South Wales abound with valuable commercial timbers. The most valuable, red cedar, is principally found on the northern rivers of the Colony, and until very recently the supply appeared so inexhaustible that little care was taken of it by the timber men, who cut all before them, provided it grew near a river where the logs could be rolled from the bank into the stream and made into a raft, which, when completed, contained timber enough to completely fill a vessel capable of navigating these rivers. These rafts had in some cases to float long distances down narrow, tortuous rivers and were towed by a boat or stern-wheel light-draught steamer. The terrible waste resulting from the squarer's axe has at last been stopped, and the stupid fashion of delivering the logs to the market in a squared state no longer exists; the consumer now gets the very best of the tree, which was previously chopped off and burned. It would be difficult to estimate how many millions of feet of the very primest red cedar have been thus ruthlessly destroyed.

Our forest trees have a dull green color, as a rule; some of the brush forests, however, contain trees with deep green and polished leaves; all trees are evergreens, altering little in appearance, if anything, with the seasons.

It is only within the last twenty-two years that the forests of New South Wales have been protected by the Government and timber reserves proclaimed. Indiscriminate felling of trees is prohibited, and only such as are of mature growth and a given girth are allowed to be cut, and then only by persons holding a license. Recently a department entirely devoted to forestry has been organized. In the year 1875 officers were appointed to supervise the reserves, which up to that time had been reserves only so far as they were proclaimed as such. Since that date other reservations have been made, and in 1881 they numbered four hundred and sixty one, having an area of three and one-half million acres. The wisdom of placing the forest lands of settled States under the control of

the Government has been fully demonstrated by practical experience. Since the adoption of this policy, owing to the prevalence of wanton and indiscriminate denudation of forest lands, and for the effectual control of the unalienated timber lands of the Colony, it has been subdivided into twenty-five districts under the supervision of resident foresters, who are controlled by travelling inspectors. It is the duty of the officers to see that all timber-cutters have their proper license, duly dated, which must be produced for examination and verification when demanded by the inspector, who also carefully examines the tree stumps or fallen timber to see that no tree of unauthorized girth has been cut.

There is a printed schedule of hard-wood trees with the girth measurement affixed to each species, under which these trees must not be felled; the girth is taken at about 5 feet from the ground; for example,—

Blackbutt	7 ft. 6 in.
Bush box	6 ft. 6 in.
Stringy bark	5 ft.

Soft woods, such as cedar, pine, beech (*Gmelina Leichtlinii*), rosewood, etc., have also their safeguard, in the prescribed girth measurement, from the woodman's axe.

At the end of 1891 the Colony had 1,013 forest reserves with an acreage of nearly 6 millions, well studded with most valuable timbers.

Licenses are issued to cut timber on reserves in class A at a fixed fee of $30.00 per annum (without royalty); on reserves in class B the fee amounts to $45.00 per annum; on reserves in class C general permits to cut timber for sawmills are issued at $30.00 per annum, to which is added a royalty differing in accordance with the value of the trees used, and ranges from 40 cents down to 6 cents per 100 superficial feet.

The license fee for cutting cedar and shipping wattle bark from river-bank is $30.00 per annum, with the reservation that no cedar tree of less than 9 feet girth is allowed to be felled.

Permits are granted also for cutting mining props, for thinning out timber in order to improve the growth of the remaining trees, and for shipping wattle bark or the bark of other trees for tanning purposes.

Infringements of any forest regulations are punishable by fine of $25.00 for the first offence, $50.00 for the second, and $100.00 for the

third, besides the confiscation of all felled and prepared timber, as well as having the cost of the injured timber charged against the offender.

For the year 1891 the revenue from such sources yielded $92,275, and the expenditure amounted to $119,375; but, although this item is so much in excess of receipts, a very great deal of useful reproductive and improvement work will result from it; as, for instance, the extensive operations carried out upon the northern reservations for the conservation of the valuable red cedar, the extensive wattle plantations, which are carefully thinned out, and the treatment of the valuable red-gum saplings on the Murray river reserves, the returns from which in a few years will fully repay the outlay.

The work carried on by the forestry department included the planting of 16,450 trees, distributing to schools 75,000 trees, thinning out of 2,000,000 red gum trees on the Murray river reserve, planting 7,000 red cedar trees on the cedar reserve, 128,000 wattles thinned out: the total number of trees operated upon exceeded two and a quarter millions. The forest area of New South Wales is estimated at 21 million acres.

During the year 1891 over 100,000 trees were supplied to public schools and corporate bodies to celebrate the Arbor Days lately introduced and so prolific of good results.

The State nursery consists of about 65 acres, carrying a stock usually of one and a quarter millions of trees, comprising over 250 varieties. All this work is being vigorously pushed under the department of forestry.

The forestry department has recently paid some attention to planting trees along the railway lines within the railway reserves, a system introduced by the executive commissioner to the W. C. E., when he held the office of minister for mines, and this scheme is likely to be greatly enlarged. On one section of the railway reserve at Cootamundra, there is a plantation of American Catalpa (Speciosa) consisting of 2,700 trees, doing remarkably well; also, a quantity of black walnut. In the cedar reserves there have been over 30,000 trees planted, taken from nurseries where they are raised, in immense numbers, from seeds.

This, briefly, is the law of forestry and the rules for forest conservation, and only a feeling of regret can be expressed that these laws and licenses were not in force many years earlier, when millions of feet of most valuable timber might have been saved and the forest of to-day would have been worth millions of dollars more than it is at

present; but by judicious planting and thinning, together with jealous care of the trees still coming to maturity, New South Wales will stand out as a bright example for other colonies to follow.

FOREST CONDITIONS AND FORESTRY PROBLEMS OF VENEZUELA.

By Dr. A. Ernst, Commissioner at World's Fair for Venezuela.

[Read at World's Fair Congress, Oct., 1893.]

Following too closely a remark made by Humboldt, most writers on the physical geography of Venezuela divide the country into three distinct zones, viz., the agricultural, pastoral, and forest. The first region comprises the mountains and valleys between the coast of the Caribbean Sea and the interior range of a rather complicated orographic system which as a prolongation of the eastern chain of the Colombian Andes runs through the whole Republic towards its northeast corner opposite the island of Trinidad, being 70 miles wide. The pastoral zone extends from the southern limit of the former to the Orinoco and Apure rivers, and consists of extended plains, interspersed here and there with raised table-lands, called *mesas*, and watered by numerous streams that in the rainy season inundate the bordering plains for many miles. The forest zone, as understood by these writers, stretches from the Orinoco southward to the frontier of Brazil, and is comparatively an undiscovered country, traversed by great rivers and covered with limitless forests, abounding with all kind of tropical birds, beasts, and reptiles.

This division, however, is but partially exact. It is true that in the first region are found almost all the agricultural establishments of the country, and that cattle-raising is the principal industry of the inhabitants of the second or pastoral region. But the most important and valuable forest-tracts are by no means situated south of the Orinoco, and are to be found within the borders of the so-called agricultural zone. There the forest begins in many places on the very shore of the sea with an almost impenetrable belt of mangrove-vegetation, composed of species of *Rhizophora*, *Avicennia*, *Laguncularia*, and *Conocarpus*, which is followed towards the land by extensive thickets of the sea-side grape (*Coccolobis Uvifera*), *Bontia daphnoides*, *Capparis amygdalina*, etc. The

slopes of the mountains are covered with forest wherever the soil is favorable and the rainfall sufficient for the development of an arboreous vegetation, and only on the highest parts, from 10,000 feet upwards, the trees disappear and are replaced by shrubs of a more or less dwarfish size.

There are, however, many instances where the mountain slopes even at lower elevations are covered only by a dense sward of grasses, amongst which grow some smaller plants of other families, especially Leguminosæ and Malvaceæ. It is extremely difficult to account for the origin of these savanna-like tracts in the midst of the forest, as the conditions of soil and climate are the same. But the grasses once well established, their roots form such a compact stratum that the seeds blown down from the neighboring trees find, of course, no place to germinate, and thus the forest cannot advance.

The luxuriance of vegetation in tropical forests is so well known that I deem it superfluous to dwell on it. The extraordinary thickness of the layer of vegetable mould which covers the soil is remarkable. The leaves are, in a great many of our forest trees, compound in a high degree—a circumstance which allows the light of the sun to penetrate to the soil beneath, and to contribute thus to the development of an abundant undergrowth of shrubs and herbaceous plants.

There is, however, in the forest a remarkable lack of flowers, which sometimes disappoints the botanical collector very much, whereas about the edges of the forest, on watercourses or open savannas, there is an abundance of flowering plants of all descriptions.

Another peculiarity of all tropical forests is the great variety of species even on a limited spot. There is nothing similar to the large and uniform oak or pine forests of the northern temperate zone; the species do not grow gregariously, but are intermixed in the most confusing manner. This is quite a serious difficulty when a certain species of timber is needed in a large quantity, as, for instance, for railway-ties, which, for this reason, are generally so expensive that the companies prefer to bring steel ties from Europe, although those made of lignum-vitæ (*Guaiacum arboreum*) are considered to be of superior quality.

Although I have been studying the flora of Venezuela for many years, I cannot say that all the forest trees of the country are botanically known to me. Every one who has seen a tropical forest

will easily understand how very difficult it is to collect in many cases sufficient material of the large arboreous species for scientific classification. In my report on the National Exposition at Caracas, in 1883, I have given a descriptive list of 652 species of trees, which were represented on that occasion by 2,070 samples. Not all of them yield valuable timber, but I am sure not to overstep the limits of truth in saying that at least one-half of that number deserve to be classed as such. There is a smaller collection of our most notable woods exhibited in the Venezuela pavilion in Jackson Park, which was partly prepared under my personal supervision, and an alphabetical list of these samples, accompanied by short descriptive remarks, inserted in the catalogue which I prepared of our exhibit.

The most important species belong to the following families: Lauraceæ, Meliaceæ, Zygophyllaceæ, Rutaceæ, Euphorbiaceæ, Leguminosæ, Myrtaceæ, Rhizophoraceæ, Rubiaceæ, Sapotaceæ, Styracaceæ, Bignoniaceæ, Apocynaceæ, Samydaceæ, and Palmæ.

Man has done hitherto nothing in Venezuela for the conservation and improvement of forests; they are in every respect such as nature has made them. Some grow on lands belonging to the nation; many are the property of private individuals; but in neither case have the science and practice of forestry been applied to them. The cutting of timber is done wherever and whenever the circumstances allow it, mostly for the benefit of carpenters and cabinet-makers in the country, and comparatively small quantities are shipped to foreign countries, especially from the ports of Maracaibo and Puerto Cabello. The trade is far from being developed, as the supply is uncertain and the expenses generally too great. The wood-cutters, of course, prefer those parts of the forest which are in the neighborhood of rivers, in order to float the logs down to the seaboard, whence they are shipped to either of the ports mentioned. Splendid timber, however, grows on almost inaccessible places, and the cost of transporting it would be much greater than its commercial value. In some cases the logs are sawn in the forest into boards and square pieces; the former generally half an inch (*foeros*) or one inch thick, and the latter (called *cuartones*) measuring about four inches each way. The work is mostly done by hand. Sawmills are as yet rather uncommon, though they might be established almost everywhere without difficulty, water-power being generally within easy reach.

The amount of lumber brought to market is, however, not quite

sufficient for the requirements of the artisans. A considerable quantity of pitch-pine is imported from the United States, principally for flooring. A large sawmill in Caracas receives likewise much square timber (pine) from this country and cuts it into boards. It is very singular that among all our many species of woods not one has been found suitable for the making of matches, so that the two large manufactories of this article at Caracas import pine wood even from Norway.

In some parts of the country the forests are recklessly destroyed by charcoal-burners. This happens, of course, especially in the neighborhood of the larger towns and cities, where charcoal has a ready sale at comparatively high prices. The public authorities have been obliged to interfere on several occasions; for instance, in Caracas, in order to prevent a decrease in the quantity of water that the rivers which have their feeders in the mountain forests carry down to meet the constantly increasing requirements of the capital. This is the only case, as far as I remember, that any provision has been made by authority of the law in reference to a forestry problem. The time, however, I hope is not far distant when the Government of Venezuela will pay a more than transitory attention to the many questions connected with our forests, and adopt a system of judicious supervision which, whilst putting a stop to all reckless destruction of forests where the water supply of any of our towns might be endangered, or irrigation in agricultural districts interfered with, will regulate at the same time the cutting of useful timber, even on lands belonging to private individuals or corporations.

THE GREAT COAST FOREST OF THE PACIFIC SLOPE: ITS RESERVATION A NATIONAL DUTY.

By E. W. Hammond, Wimer, Jackson County, Oregon, Vice-President American Forestry Association.

[Read at World's Fair Congress, October, 1893.]

The object of the present paper is the advocacy of the reservation, by the General Government, of the great coastal forest of the Pacific slope, this being a matter of prime importance in any comprehensive plan for an intelligent administration of the public forests.

This great coast forest is one of the four principal divisions into which Prof. Sargent, in "Trees of North America," divides the woods of the Pacific region.

It extends southerly along the coast in a narrow strip from the sixtieth to the fiftieth parallel, where it widens, embracing the shores of Puget Sound, and, following the abundant rainfall of the region, extends eastward over the high mountain ranges north and south of the boundary line, covering Northern Washington, Idaho, and portions of Western Montana. South of the fiftieth degree of latitude the coast forest occupies the region between the ocean and the eastern slopes of the Cascade range. In California the summit of the Sierra Nevada marks the eastern limit of the coast forest, which gradually disappears south of the thirty-fifth parallel, although still carried by the high ridges of the coast range nearly to the southern boundary of the United States. Owing to the influence of favorable climatic conditions, this region is one of the great forest centres of the continent, where, with unusual density of growth, is produced timber of the grandest proportions, not surpassed within the temperate zones.

When the fact is realized that, at the present time, as shown by the Chief of the Forestry Division in an address before the Real Estate Congress at Nashville, Tenn., in 1892, we are cutting from our forests each year an amount of timber equal to twice the annual reproduction; and when it is known that we are cutting timber at a rate which will exhaust the entire forest capital of the country within a period of from 60 to 70 years at the most, allowing for increased consumption due to increased settlement and development of the country, it is evident that the establishing of great forest reserves at the present time is only a matter of common prudence and foresight.

From a comparison of the estimates of timber consumption and reproduction it is evident that the time has arrived when it is essential to take thought concerning the future of the timber supplies. More than this, there is cause for alarm at the prospective injuries threatening the country from changed conditions, disturbing the waters and impoverishing the soils—results of the present irrational treatment of the great forest property of the nation.

It now appears, from a study of past developments, that a not inconsiderable portion of the arid regions of the far west and southwest will yield to the progress of agriculture, and that the next great movement in the settlement of the American continent

will be the more complete occupation of the Pacific slope and the utilization of those portions of the vast arid interior which may be secured to agriculture by the employment, through irrigation, of the waters now largely running to waste.

After the occupation of this great region by a population such as now generally anticipated, the forests of this area will not long sustain the attacks made upon them unless the General Government comes quickly to their rescue and devises some plan for their rational management. There are some large and valuable bodies of timber upon the western slopes of the northern Rocky Mountains and on the high plateaus and mountain ranges of Arizona and New Mexico, which, with any rational management, will afford a sufficient supply of fuel and lumber for the local needs for a long time. The remaining woodland of this region consists mainly of scattered and stunted growth, of little value except for fuel, fencing, and for mine-props.

Aside from the great timbered areas and this scattered growth, the whole western arid region is practically treeless. The only exceptions are the forests upon the Blue Mountains of eastern Oregon, and upon the sparsely-timbered ridges of central Nevada. But the forest growth upon these has only a local value, and in Nevada is apparently doomed to early extinction. The once magnificent forests of the eastern portion of the United States are being rapidly depleted of their commercial timbers to meet the demands for lumber of a great and growing country, partly through the habits of our people in the extravagant use of the wood, and even more largely by the annually recurring forest fires—the results of wilfulness, carelessness, ignorance, or greed.

It is evident that the future population of the treeless interior region must look for the necessary supplies of timber to the mountain ranges upon the extreme western border of the continent. The magnificent tracts of pine and fir which clothe the sides of the Sierra Nevada and the great redwood forests of the California coast may yet be preserved in part. But the vast primeval forests of the northwest coast, and especially the great coniferous areas of Oregon and of Washington, which lie within the limits of the great coast forest, as above described, must be the chief reliance in this respect. Here the climatic conditions are such as to render the maintenance of forest conditions a matter of comparative ease.

The purely local considerations immediately concerning the communities in which the proposed forest reserves are situated, it is not

the purpose of the present paper to discuss. It may be said, however, that it is the positive duty of the Government to insure the perpetuation of sanitary conditions dependent upon the maintenance of an abundance of pure and wholesome water in springs and streams. It also may justly be considered as within the duty of the Government to foster and encourage all legitimate industries of the country in so far as this may be done by a wise and conservative management of the natural resources upon which these several industries depend. This is especially the case when these resources are of such a character that the Government alone has the controlling power.

The opinion largely prevails among those not properly informed that the purpose of the forest reserves is to withhold from present use large bodies of valuable timber, thus retarding the development of the region. This is not the case. The purpose is mainly that these forest properties shall be so managed that their productive capacity shall not be seriously impaired. Besides being retained as regulators of our water supplies and perpetuators of sanitary conditions, they should be made to produce indefinitely, under a wise management, a succession of valuable crops of timber.

These lands, covered by these forests, being unsuited for general agriculture, should thus be kept in useful occupation. Their value to the nation as perpetual producers of an important natural resource should be recognized by their being dedicated by the nation to this useful purpose. As permanent timber reserves, all danger from changed conditions of water supply, in so far as dependent on forest conditions, would, of course, be averted.

Of the many reasons for placing the great forests of the northwest coast under Government control as timber reserves, a most important one is that, notwithstanding the abundant annual precipitation of this region, the rains are distributed so unequally as to leave these forests for a good portion of the year exposed to the risks of fire. During the summer and fall, the whole country becomes little better than a vast tinder-box, and in the absence of any care extensive forest fires prevail every year.

It appears to be a favorite theory in certain quarters that these annual fires are mainly the result of the carelessness of campers. But, from a long residence on this coast, and an intimate acquaintance with the people here, the writer is convinced that in many cases these fires are set purposely by ignorant and irresponsible persons, unconscious of the injury or indifferent to results. As

a result of the recent wide discussion of forestry matters by the press of the country, and the information sent out by the forestry division at Washington, a more general appreciation of the value and importance of the forest has begun to prevail. But nothing short of the presence of a paid fire patrol, intelligent, energetic, and alert, would be in the least effective in restraining the reckless and ignorant who are to be found in every community.

The forests, if left to nature, would doubtless, under the influence of the abundant rainfall of the region, recuperate themselves in time, although every stick of merchantable should be cut from them—with this important difference: under our present irrational methods of lumbering, ordinarily all the finest trees are among those felled, and only worthless specimens are left to seed the ground. Under such circumstances the usefulness of the forest as a timber-producer in time becomes seriously impaired, which it is not the part of wisdom for the Government to permit. The nation must have due regard for the interests of the future community as well as for those of the present. Hence, it cannot wisely permit wanton destruction. With the rational methods of lumbering under Governmental control of the forests, as in the proposed timber reserves, a succession of equally good, or even better, crops could be secured, since the composition of the forest as to desirable kinds would be in a measure under control.

As to the location of the boundary lines of the proposed timber reserves, these should be designated only after a full investigation and study of the region by a body of competent scientific men. In determining the extent of the proposed forest reserves the preservation of the streams should be of first consideration. This is a matter of such great importance that further inroads upon these forests should not be permitted until this matter has been fully considered; and this can only be intelligently done after a complete survey and examination. In my opinion, this matter of the preservation of the streams is of such paramount importance that nothing should be allowed to stand in the way. Next to this the local needs as to timber supplies—both as to the present and the future—should be carefully considered. Lastly should be taken into the account the demands which commerce is likely to make in the future upon these forests.

This preliminary investigation and study of the forests and of the needs of the country should be most thorough. In the meantime, whatever power the act of March 3, 1891, has conferred upon

the President in the way of establishing timber reserves it is to be hoped will be employed by him in the selection of proper sites for such reservations wherever, as in the case of the great forestal region under consideration, these can be shown to be of sufficient national importance.

FOREST RESERVES OF THE WESTERN MOUNTAIN REGION.

By Edgar T. Ensign, Colorado Springs, Col.

[Read at World's Fair Congress, October, 1893.]

In the Congressional act of 1876 providing for a forestry investigation, and, subsequently, the formation of a forestry division in the Department of Agriculture, the Federal Government took the first decisive steps toward conserving the forest wealth of the nation and averting the evils consequent upon the indiscriminate destruction of forest growth. In the admirable work since performed by the forestry division, there is found ample justification for its creation and continued existence.

In March, 1891, another decided advance was made in forestry legislation. Congress then incorporated in the revised land law the following provision:

"Section 24. That the President of the United States may from time to time set apart and reserve, in any State or Territory having public land bearing forests, in any part of the public lands wholly or in part covered with timber or undergrowth, whether of commercial value or not, as public reservations, and the President shall, by public proclamation, declare the establishment of such reservations and the limits thereof."

This law is the result of long and persistent advocacy of the reservation and classification of all public timber lands. During the brief period of its existence, no less than sixteen large forest reserves have been established, most of them in response to local requirement. Except in one instance, they are situated in the States and Territories of the western mountain region, usually upon the high ranges, at the sources of streams. In extent they vary greatly, the largest one embracing some 6,400 square miles, nearly twice the area of Delaware and Rhode Island. The aggregate extent of the

reservations is about 22,000 square miles, or something more than the total area of Massachusetts and Maryland. It should be noted, however, that the areas given are the estimated areas lying within the exterior boundaries of the reservations. The lands actually reserved are only the vacant, unappropriated public lands within the established boundaries.

The distinction between national parks—created by earlier legislation—and forest reservations should not be overlooked. The former—as, for example, the Yellowstone National Park and the Yosemite—were established by special acts of Congress; individual titles, if any, within their borders were extinguished, and in their government the principle of excluding private interests prevails. Forest reserves, as we have seen, are established under a general act; no private holdings therein, whether perfected or not, are disturbed; and it is the declared policy of the Government to provide, under proper safeguards, for the necessary use of timber upon the reservations, and the development of their natural resources.

It should be noted, however, that somewhat anomalous conditions now exist within the territory of the reserves. In the case of my own State, Colorado, the formation of forest reservations has been effected at the instance of the resident population, but with the understanding that, with respect to the territory reserved, permits would be granted for the necessary use of timber, prospecting, mining, development of coal, stone, marble, and other deposits, construction of irrigation works, etc. Practically, however, under the terms of the proclamation, all rights of user or entry upon the lands are denied; and the Government authorities state that these prohibitions will continue until Congress provides a system of administration for the reserves.

Existing public forest reserves may be divided into two general classes:

1. Those created principally for the conservation of forest growth, in view of its effect upon the volume and flow of streams.

2. Those established mainly for the preservation of natural scenery, or for other reasons, without special regard to the conservation of water.

To the first class belong the reserves in California, Wyoming, Colorado, and New Mexico, and many others that have been proposed. To the second class may be assigned the reserves in Washington, Oregon, and the Grand Cañon reserve in Arizona. And with the latter should be named the Yellowstone, Yosemite, General

Grant, and Sequoia national parks, were these under consideration. The several forest reservations are herewith given, noting briefly not only those that have been established, but certain other proposed or desirable ones.

WASHINGTON.—In this State is the *Pacific Forest Reserve*, situated on the Cascade range, overlooking the southern waters of Puget Sound. It is quadrangular in form, and has an estimated area of 1,512 square miles. Mount Tacoma, with its snow-covered summit and wonderful glacial system, is the central feature. The tract also includes Paradise Valley, the Nesqually Palisades, the Cascades of Lost River, and numerous hot springs. West of the summit the Cascade range is covered with the heaviest continuous belt of forest growth in the United States, this extending over the slopes of the Coast range also. Additional forest reserves will doubtless be established in this State.

OREGON.—In June, 1892, was issued the proclamation establishing the *Bull Run Timber Land Reserve*, in the northwestern part of the State. This reservation is also on the Cascade range; it is irregular in form, and has an estimated area of 222 square miles. It includes Mount Hood, and is bordered on the north by the Columbia river. Later a far greater reservation was made, including a large part of the heavy forests of the Northern Pacific region. These follow the Cascade and Coast ranges, and extend through Western Oregon, from the Columbia river southward, some 200 miles. This belt is 50 to 100 miles wide, and large portions of it lie at an altitude of 7,500 feet and upwards above the sea. Upon the summits of the high ranges snow and ice remain continuously; and here, also, many glaciers are formed. Upon the continued existence of these forests, from which flow powerful streams, depend the irrigation privileges of a country the approximate area of which is 20,000 square miles.

CALIFORNIA.—The *Sierra Forest Reserve*, the most notable, extends for a distance of nearly 180 miles. It adjoins the Yosemite National Park on the south, and the Sequoia and General Grant National Parks on the west. The mountain crests in this reserve vary in height from 2,000 to 12,000 feet. The *San Bernardino Forest Reserve*, still further southward, has an estimated area of 1,152 square miles, the greater portion consisting of coniferous forests.

Immediately west of the last-named reserve lies the *San Gabriel Timber Land Reserve*, similar in character, and having an estimated area of 868 square miles. Southward, upon the Santa Ana Moun-

tains, is the *Trabuco Cañon Forest Reserve*, having an estimated area of 78 square miles.

All of the California reserves cover the sources of important streams, the waters of which serve to irrigate some of the richest portions of the State.

The heavy forests of California are confined to the Coast range, the eastern and western slopes of the Sierra Nevada, and the group of mountains joining these ranges in the northern part of the State. Although the forest reserves already established include about 8,500 square miles, other reservations are likely to be formed in the heavily timbered districts of the northern Sierra Nevada and Coast ranges. In fact, for the highest development of the region all of its native forests should be carefully conserved.

ARIZONA.—In Northwestern Arizona has been formed the *Grand Cañon Forest Reserve*. It is quadrangular in shape, and has an estimated area of 2,893 square miles. The Colorado river flows through it, entering at the northeast. It embraces the most striking features of the Grand and Marble Cañons, also a considerable portion of the Kaibab Plateau, and on in its southern portion the Coconino Forest. The region has already become famous for its gigantic and impressive scenery. It will take high rank among our great natural parks. The heavy forests of pine and fir which cover the sources of streams, important to the irrigation interests of the Territory, should be protected.

UTAH.—The Wasatch and the Uintah mountains, as well as portions of the great Colorado Plateau, bear at high elevations coniferous forests of considerable extent. The western flanks of the Wasatch range have been nearly stripped of good timber for the supply of the valley settlements, and there is need of early and adequate provision for the conservation of the forests and streams.

IDAHO.—Upon the western slopes of the mountain ranges separating Idaho from Montana and Wyoming are found the principal forests of the first-named State. No forest reserves have, as yet, been established in the State. One has been proposed, adjoining the Yellowstone National Park on the west, and including some timbered lands in Montana. Besides this is the proposed *Meadow Creek Forest Reserve*, in Northwestern Idaho. An important timber belt is one covering the high divide between the Salmon river on the north and the Weiser, Payette, Boise, and Wood rivers on the south. To denude this region of its timber would be exceedingly disastrous to the agricultural interests of Southern Idaho. Doubtless a num-

ber of forest reserves, in addition to those named above, should be established in the State.

MONTANA.—In this State the most dense and continuous bodies of timber are found on the western flanks of the main range, and on the Cabinet, Cœur d'Alene and Bitter Root mountains, which are contiguous to it. These forests, which extend to Eastern and Northern Idaho, are among the most extensive and valuable of any in the Rocky Mountain region. A number of proposed forest reservations in this State are in various stages of progress; none, as yet, being established.

WYOMING.—It is quite generally known that the Yellowstone National Park is mostly situated in Wyoming. It covers an area of nearly 4,000 square miles, at the northwest corner of the State. One of the new forest reserves, called the *Yellowstone Park Timber Land Reserve*, immediately adjoins the tract on the east and south, being substantially an addition to the park. Its estimated area is 1,936 square miles. It possesses remarkable natural features, bearing a general resemblance to those of the park itself. In addition to the Yellowstone reservation, two or three others have been suggested, and are in course of investigation.

COLORADO.—Colorado was among the first of the Western mountain States to agitate the question of forest reform. She has already secured a number of important reservations, and other proposed reserves are in the preliminary stages.

The *White River Timber Land Reserve*, proclaimed in October, 1891, was the first of the forest reservations established under the new law. It is situated in the northwestern part of the State, on an elevated, wooded plateau, and has an estimated area of 1,872 square miles. Southwestward of this, and quite near, is the *Battlement Mesa Forest Reserve*, which embraces within its boundaries two large, timbered plateaus, known respectively as the Grand and Battlement Mesas. The estimated area of this reserve is 1,341 square miles.

The *South Platte Forest Reserve*, in Central Colorado, has an area of about 1,068 square miles. It occupies the high ranges immediately surrounding South Park, and nourishes many of the tributaries of the South Platte river. Lost Park, a favorite haunt for wild game, and affording refuge for a small band of buffalo, forms a portion of this reserve. The city of Denver, and adjacent farming country, are largely dependent upon the streams of this

region for their water supplies. Immediately east of this is the *Plum Creek Forest Reserve*, a triangular tract of wooded, mountain country, proclaimed as a reservation in June, 1892, and having an estimated area of 280 square miles.

The *Pike's Peak Forest Reserve* lies adjacent to and south of the one named above. It embraces the greater portion of the Pike's Peak range, including the mountain of that name. Its area is about 288 square miles. The streams flowing from it afford water supplies for Colorado Springs, Manitou Springs, Colorado City, and other smaller towns, and also furnish irrigating waters for the adjacent agricultural valleys.

The Colorado State Forestry Association has memorialized the President, asking for the reservation of all public timber lands in the State, situated upon the high ranges. Many prominent citizens and officials also joined in the request. So far as known, no official action has been taken thereon.

New Mexico.—The *Pecos River Forest Reserve* is in Northern-Central New Mexico, covering a portion of the rugged mountains known locally as the Taos range, and lying in the vicinity of and northeastward of Santa Fé. Its estimated area is 486 square miles. It includes the sources of the Pecos and Canadian rivers. The proposed *White Oaks Forest Reserve*, in the south-central part of the Territory, is under investigation. Another proposed reservation covers the Sacramento mountains, a range situated near the southern boundary of the Territory. The desirability of forming a large reservation upon the Mogollon and Tularosa ranges, near the western border, has also been suggested.

The limits of this paper do not permit me to dwell upon the peculiar characteristics and attractions of the several forest reserves. While some of them embrace most remarkable natural features, they all, without exception, include woodland and mountain scenery of great interest. They abound in running streams, waterfalls, and deep, clear lakes. Their rugged heights afford striking contrast to adjacent sheltered valleys and natural parks. Within their deeper recesses are the habitat of native wild game and fish, which, as well as the forests, need the protecting care of the Government.

Now that so many extensive forest reserves have been established, and others likely to be formed soon, the question of immediate importance is, What provision shall be made for their due administration?

The public lands, including these reservations, are under the con-

trol of the Secretary of the Interior. That officer, doubtless, has sufficient authority to formulate regulations for the government of the forest reserves. Unfortunately, the means at his command for the enforcement of such provisions are inadequate, and Congress alone can afford relief. Various measures in this behalf have been proposed. Many advocate the use of the mounted troops of the regular army for the protection of these reserves. This plan has already worked well—at least in the one or two instances where it has been tried. The small cavalry command at the Yellowstone Park and reservation renders excellent service in the prevention of forest fires and of depredations.

LIST OF NATIONAL FOREST RESERVATIONS AND NATIONAL PARKS OF THE UNITED STATES.

No.		Established.	Estimated area.*
			Acres.
1	Yellowstone National Park timberland reserve (Wyoming)	Sept. 10, 1891	1,239,040
2	White River Plateau timberland reserve (Colorado)	Oct. 16, 1891	1,198,080
3	Pecos River forest reserve (New Mexico)	Jan. 11, 1892	311,040
4	Sierra forest reserve (California)	Feb. 14, 1893	4,096,000
5	Pacific forest reserve (Washington)	Feb. 20, 1893	967,680
6	Pike's Peak timberland reserve (Colorado)	Mar. 18, 1892	184,320
7	Bull Run timberland reserve (Oregon)	June 17, 1892	142,080
8	Plum Creek timberland reserve (Colorado)	June 23, 1892	179,200
9	South Platte forest reserve (Colorado)	Dec. 9, 1892	683,520
10	San Gabriel timberland reserve (California)	Dec. 20, 1892	555,520
11	Battlement Mesa forest reserve (Colorado)	Dec. 24, 1892	858,240
12	Afognak Forest and Fish Culture reserve (Alaska)	Dec. 24, 1892	Unknown.
13	Grand Canyon forest reserve (Arizona)	Feb. 20, 1893	1,851,520
14	Trabuco Canyon forest reserve (California)	Feb. 25, 1893	49,920
15	San Bernardino forest reserve (California)	Feb. 25, 1893	737,280
16	Ashland forest reserve (Oregon)	Sept. 28, 1893	18,560
17	Cascade Range forest reserve (Oregon)	Sept. 28, 1893	4,492,800
	Total acreage of forest reserves		17,564,800
	NATIONAL PARKS.		
18	Yellowstone National Park	Mar. 1, 1872	2,142,720
19	Yosemite National Park	Oct. 1, 1890	967,680
20	Sequoia National Park	Oct. 1, 1890	161,280
21	General Grant National Park	Oct. 1, 1890	2,560

* It must be understood that the lands actually reserved are only the public lands that were vacant and unappropriated at the date the reservations took effect—something less than the areas above given—they being the estimated aggregate areas within the boundaries of the reservations. Title to portions of the lands within the reserves has passed out of the United States, and still other tracts are occupied by *bona fide* settlers, who located before the creation of the reservations, and who are not interfered with as long as they comply with the law, and who can complete titles upon showing their compliance with the law.

FOREST ADMINISTRATION—FEDERAL OR STATE?

By GEORGE H. PARSONS, Colorado Springs, Col., Vice-President American Forestry Association.

[Read at World's Fair Congress, October, 1893.]

"Trees are the best friends of man, and forests of nations." The single tree may be pruned and cultivated and brought to its full perfection of beauty and usefulness by the individual; but the great forests which cover the surface of the earth, the growth of centuries and far-reaching in their influences, can be effectually protected and preserved only by the community itself, which alone is able to combine the interests of all. But the question may well be asked, What is the nation? The foundation of the United States of America is shown by its motto, and where there is one nation made from many nations, the question arises, Which nation shall control the forests—the one or the many, the central government or the State governments?

In the early days of the existence of this Government the public lands were held by the States alone, and all action relating to the forests was necessarily at that time undertaken by the States within whose borders the forests were. But as new territory was added a large amount of land came into the possession of the Federal Government, which is estimated at nearly three million square miles. A great portion of this has been sold, but there still remains an immense area, including about 50,000,000 acres of forest. This is a large tract to watch and guard properly, and the question for us now is, How shall it be done? Shall we follow the tendency of our country toward centralization? Can the Federal Government do this work, or must it be divided among the States? This is one of the problems of the age, and the sooner it is seriously considered the better, for upon its prompt solution depends a large and most important area of forests, with the welfare of a great country.

The best teacher is experience, and the results of past efforts are the only sure guides for future enterprises. We will, therefore, in connection with the question before us, briefly examine the work for forestry from the earliest settlement of this country, and, by

comparing the enactments of State legislatures with the achievements of the Federal Government, draw our conclusions for the solution of this problem.

In the settlement of the country the forest was an impediment to the progress of civilization. It covered the land, and must be subdued by axe and fire before food could be had for the people. In its dark recesses lurked a thousand dangers, so that antipathy was aroused against it, which descended from father to son for many generations. Still there were some wise men in that far-away time who knew the beneficial influences of the forest, and lifted their voices in protest against its destruction. Probably the earliest colonial action relating to forests was in Massachusetts, where certain regulations concerning damages from forest fires were placed on the records in the year 1631. Towns, as well as the general court, took action for the protection of the forests. Before the end of the seventeenth century the cutting of timber, except under certain conditions, was forbidden in Connecticut, New York, or New Netherlands as it was then called, and Pennsylvania. In the latter community was the wise provision of the governor, William Penn, "that in clearing the ground care be taken to leave one acre of trees for every five acres cleared." In the early part of the next century Rhode Island, New Hampshire, New Jersey, and Delaware adopted laws to prevent fires and the general cutting of trees. The province of New Hampshire had, in 1708, a surveyor-general of forests appointed by royal authority.

After the formal organization of the Government of the United States we find that the laws of colonial times to prevent forest fires were continued everywhere, and now each State and Territory has some law providing more or less severe punishment to any person setting fire to woodland or prairie. There is a great similarity in all legislation of this nature, but as it is very difficult to find the offender, or to convict him afterwards, laws of this class are operative, if at all, by their threat rather than by their execution. With few exceptions, this law has become a dead letter. The forests are consumed now as frequently and extensively as ever. The census of 1880 shows that 10,000,000 acres of forests, valued at $25,000,000, were destroyed by fire in the United States in that one year. This may be considered as below the average, for an estimate by the Forestry Division last year showed that more than 12,000,000 acres of woodland were burned over during 1891. This loss does not take into consideration the very great damage done to property

other than the forest. The only States said to be comparatively free from forest fires are Maine and Massachusetts, and especially New York, whose forest commissioner reports that they are now a thing of the past.

Another law, adopted very generally, is one to encourage the planting and growing of timber and shade trees. This is found on the statutes of twenty-two States and Territories, or about half the total number. It generally provides for a bounty to be paid for a certain number of growing trees, or for a rebate in the tax on land so planted. These may be planted in clumps, or along the roadsides, and land so cultivated shall not be assessed for improvements. Penalties are also laid upon any one convicted of injuring any tree. This law has been adopted more generally in the prairie States, where trees were lacking to so great an extent that the settlers became tree-planters almost from necessity. It has been the means of covering with trees thousands of acres, and has driven the prairies many miles westward. Kansas is credited with the largest area planted with forest trees, nearly 120,000 acres, and Nebraska comes next with 78,000 acres. This law has done much good, but, after all, tree-planting along roadsides and in small, isolated clumps is not forestry, and legislation of this kind, though indirectly aiding the cause in an educational way, does not preserve nor create forests.

In the same direction of education is the appointment of Arbor Day, which has now become a legal holiday in thirty States and Territories. It is celebrated in the public schools, and is thus made a most important factor in creating an interest in trees and a knowledge of vegetable life among people at their most impressionable age.

A legislative action of late years, which was thought would result in great good to the forests, was the appointment of regular forest commissioners or commissions. The duties of these officers are principally to prevent and extinguish forest fires, bringing the guilty ones to punishment, to report regularly to the governor all things pertaining to the forests in the State, and in every way to preserve the forests and represent their interests. These were first created in 1885 in four States—California, Colorado, New York, and Ohio. Kansas and Michigan followed in 1887, Dakota in 1890, Maine in 1891, and Pennsylvania in 1893. Massachusetts has directed its State board of agriculture to act as a board of forestry. The commissioners began work actively and enthusiastically, but at the present time it is a question whether they are

able to do much good. One of the most efficient at first, that of California, which established several experimental stations and acquired considerable property, has failed to accomplish what was expected. It became a political machine, under the control of "practical politicians," who used it as a means of partisan reward, and gave no attention to forestry. The outcome was the abolition of the commission, the turning of its property over to the University of California, and the transferring back to the United States of the Yosemite Park, because the State was incompetent to manage it. The forest commissioner of Colorado no longer exists, the legislature having failed to appropriate money for his expenses. The New York forest commission is the only one which has really accomplished anything. This is owing to the large State ownership of forest lands and the large annual appropriation. It has set aside as a forest reserve an area of nearly a million acres in the Adirondack region and Catskill mountains, and a bill is now before the legislature for the issuing of bonds for $750,000 for the purchase of more land for this purpose. But in this large tract no real forest management exists, although the protection is quite complete.

As long ago as 1888, Prof. C. S. Sargent wrote in the *Garden and Forest*, "The field of usefulness of these commissions is limited, and the work must be advisory and educational. They must become, if they are to justify their existence, the teachers of the people in all that relates to the forest." The Ohio forestry bureau, in its report for 1888, frankly accepts the position of Prof. Sargent, and plainly states that "the great object of its promoters has been to furnish the people of this great State the much-needed information in matters pertaining to forestry." Education may be now accepted as the only work which can be accomplished by the State forest commissioners or commissions.

What is the result of the legislative action of the States in relation to the forests? Fires still burn as before, and devour annually many times as much lumber as is cut by the saw-mills. The encouragement of tree-planting by bounties and tax-exemption has in no way increased the area of forest land, and the forest commissions have become mere boards of education. As far as any practical benefit is concerned all the laws now on the State statute-books relating to forests might as well never have been enacted.

And now let us turn to the Federal action in relation to forests. The first movement of the General Government to preserve the

timber was for the building of a navy. In 1799 Congress appropriated $200,000 for "the purchase of growing or other timber, or of lands on which timber is growing, suitable for the navy, and for its preservation for future use." Under this act two small islands on the coast of Georgia, containing together about 2,000 acres, were purchased. Nothing more was done until 1817, when an act was passed directing the reservation of such public lands, producing live oak or red cedar, as might be selected by the President. Under this act about 19,000 acres were reserved in Louisiana, and ten years later 11,000 acres were acquired by purchase. By additional acts of 1820 and 1827 the President was authorized to take proper measures to preserve the live-oak timber growing on the lands of the United States, and to reserve such lands in sufficient quantities as to render them valuable for naval purposes. Under these various acts nearly 250,000 acres were reserved in Alabama, Florida, Louisiana, and Mississippi. In 1822 an act was passed authorizing the President to employ the land and naval forces to prevent the destruction of timber in Florida, and to take such other measures as might be advisable for the preservation of the timber there. By an act of 1831 provision was made for the punishment of persons cutting or destroying any trees growing on the land of the United States. Under this act, up to the present time, all the protection they have had has been secured for the public forests. Until 1855 this protection was carried on under the Treasury Department. But in that year it was transferred to the Land Department, where it has been somewhat effective for the prevention of trespassers upon the public lands.

After the action above named, which was more on account of the navy than of any recognition of the beneficial influences of the forest, nothing more was done by Congress for its forests until 1876, although many bills were introduced more or less connected with timber lands. In this year the timber-culture act was passed, by which a person planting and maintaining 40 acres of timber trees on Government land was entitled to 160 acres at the expiration of ten years. This was changed twice, and finally amended in 1878 so as to reduce to 10 the number of acres planted. In this form it remained until 1891, when it was repealed for the reason that, owing to its crude provisions and the lack of proper supervision, it had been abused, and had given rise to much fraud. It is estimated that about two million of acres were planted with groves under this law. They will prove of benefit to the districts in which they lie,

but it is a question whether this benefit will compensate for the fraudulent acquisition of a large amount of land from the Government.

So far, we have seen that the action of the Federal Government had done little good for forests. But the time was at hand when the voices of those crying in the wilderness would be heard. It has been truly said that the interest in the preservation and conservative use of our natural forest areas was first systematically aroused when Mr. G. B. Emerson and Dr. F. B. Hough, in 1873, engaged the attention of the American Association for the Advancement of Science in the subject, and a memorial from that association to Congress led to the enactment of a law, in our centennial year of 1876, directing the Commissioner of Agriculture to appoint a competent person to make inquiries and investigations into the destruction of our forests, and into the measures necessary for the preservation of our timber. Dr. Hough was at once appointed, and made two reports. This action led to the formation, in 1882, of a Forestry Division of the Department of Agriculture, with Dr. Hough as its first chief, followed by Mr. N. H. Egleston. In 1886 Congress made this Division an integral part of the Department, when the present most able and efficient exponent of forestry, Mr. B. E. Fernow, took charge of it. With the organization of this Division the interest of the Federal Government in the preservation and growth of forests may be said to have begun. Its policy has been to establish a regular system for gathering and disseminating information regarding the forests of the United States. Special agents were appointed to investigate the needs of different portions of the country, and a large amount of material has been published. Considering the brief period this Division has been at work, great progress has been made. It may be said, without hesitation, that nowhere else, within an equal compass, is there to be found in the English language such an amount of information in regard to the subject of forestry. Necessarily its work at first had to be chiefly historical, statistical, and educational. The Forestry Division has carried on the theoretical branch with great success, and prepared the way for the practical, which is now at hand.

If the interests of the Federal Government in forests was first shown by the organization of the Forestry Division, its first practical movement for their care and preservation may be considered to have been the act of Congress of March 3, 1891, by which the President was authorized to set apart and reserve any portion of the

public lands, wholly or in part covered with timber or undergrowth, as public reservations. This action is a most important step towards a proper forest policy on the part of the Government, and marks a new era for this country. The law was followed up actively by the administration, and fourteen reservations have been proclaimed by the President, aggregating 13,000,000 acres,* and lying in Arizona, California, Colorado, New Mexico, Oregon, Washington, and Wyoming. A number of locations have been temporarily withdrawn from the market and are now subject to examination prior to their final permanent reservation. Other reservations have also been made by special enactment and not under the law of 1891. The first of these was the Yellowstone National Park, created in 1872. Then followed the Yosemite, the Sequoia, and the General Grant National Parks in California, the Hot Springs Reservation in Arkansas, and the Chickamauga National Park in Tennessee. These comprise about 3,500,000 acres. There is every expectation that this work, so well begun, will continue until all the forest lands of the United States are permanently reserved from sale. With such a large area some provision becomes necessary for their protection and administration. And thus we come back to the question we started with, a solution of which we are earnestly seeking.

Our examination of history has shown that all the State forest legislation since colonial times has been ineffectual, except, perhaps, in New York, where peculiar conditions exist. It has shown that little of the national legislation has been available for good, and a century of ignorance passed before the first effective enactment by Congress was secured. We have learned from the experience of the past that for some reason the State government is not as yet capable of grasping the needs of this problem, and providing for it an adequate solution. It may be that the local requirements, the individual interests, and the grasping nature of monopolies, with the tendency to drift into the control of unscrupulous politicians, form a barrier against the preservation of the forest by the State. On the contrary, the legislative and executive branches of the National Government are able to take a broader view of the requirements of the case, are not so trammelled by local interests, and, having a more thorough organization than the State, may command and obtain more efficient aid. Certainly no one will deny that from the results of over a hundred years the Federal Government has shown itself

* Now 16 reservations, with over 17 million acres.

better able to work out this problem and apply its solution than the governments of the States.

There are other reasons for the administration of the forests by the National Government which will occur to many, but I will now present but two. One of the most important of the many beneficial influences of the forest is the protection it affords to the springs and brooks, thus maintaining a regular and steady supply for the large rivers which flow through the length and breadth of our land. These rivers cross several States, and it will be very difficult for those in one State to legislate to preserve in their full efficiency the fountain-heads of a river which lie in another State. Truly, any work involving the welfare of two or more States must of necessity be carried on by the General Government, for no one State can be depended on to legislate for the benefit of another.

But the most important argument in my mind for the national control of the forest is that in the military department they have an organization ready to undertake, with little extra expense, the immediate and most effective management of not only the reserves and parks already made, but of all the forest area. Something must be done at once. Over ten millions of acres of forest are destroyed by fire each year. It is criminal to stand idle while this great loss is going on. We cannot afford to wait for the slow educational methods by which alone we are able to secure the necessary action of legislature and Congress for a thorough forest administration. By a brief resolution Congress may authorize the Secretary of the Interior to call upon the military department to aid him in the preservation of the forest. It is not an impracticable plan, and two years ago was approved by Thos. H. Carter, Commissioner of the General Land Office, who has had long experience in the prosecution of timber thieves. It also receives the approbation of many officers of the army.

The Chief of the Forestry Division lays down the following principles for forest management: "(1) proper organization of an efficient service; (2) protection against theft, fire, or other damage of property; (3) regulation of the occupancy and the use of the reservations by citizens; (4) a system for cutting the crop and marketing it according to the needs of the population; (5) reproduction of the crops and maintenance of proper forest conditions." Surely these principles may be applied effectively by the army, and there is abundant precedent for this action. The Yellowstone Park has been for a long time under the admirable care of a troop of

cavalry, and so has the Yosemite Park. In British India, when the forest department was first created, the officers were taken from the army, and this custom has prevailed in certain countries of Europe. Under this plan the forest would be regularly patrolled by a mounted body of active, disciplined men, accustomed to hard riding and quick action in all emergencies, and fully under the control of officers whose rule in life is full performance of duty, no matter what the consequences.

Nor would the benefit be to the forest alone. The army would thus have an object for its existence in times of peace, and would render some return for the great expense of its maintenance. The long marches through the wild mountain regions of the forests would accustom the men to the hardships of campaigning, and a school would be provided which would prepare them for war far better than any drill of camp or field. As shown in our last great war, where military operations were almost invariably carried on in wooded countries, an intimate knowledge of forest operations and forest life is of great advantage to all troops. The best soldiers have always been those born and bred in mountain forests. Lieutenant Wood, in command of the Yosemite guard, says "that the work makes better soldiers and better men of his command, and the men and animals are infinitely better prepared for any real military work than they could be by any garrison duty." He speaks also of the improved moral tone of the men. Mr. Carter, the former Land Commissioner, states "that the army, both officers and men, have been not only prompt, but enthusiastic in aiding to preserve the parks, and all that makes them beautiful and instructive." Colonel Merriam, in charge of the military post at Denver, Colorado, strongly favors the use of the army to guard the Government forests. But he does not wish to see the army degenerate into a mere police force. It is obvious that, although at first this would be their chief duty, it would not be the final result. Very soon would arise the work of developing the many resources of the forest, and if it remain under the charge of the army, there would soon be a chair of forestry at West Point, and officers regularly drilled in the various operations of true forest administration.

From the study given this problem, it has been found that the only solution is for the Federal Government to continue the creation of forest reserves, so well begun, and turn them over to the care of the army. In this way the terrible destruction of the forest will be at once checked, and gradually a complete and thorough

system of forestry will be developed fully adapted by experience to the peculiar customs and needs of this country. Let us hope that the beginning of a new century will see the Government of the United States fully committed to a sound forestry policy, and actively engaged in a thorough and effective administration of our magnificent forests.

TIMBER AND WOOD CONSUMPTION IN THE COMSTOCK MINES.

By William Alvord, San Francisco, California, former president of the American Forestry Association.

The successful operation of the mines of the Comstock lode requires vast quantities of timber, lumber, and wood, for the walls and ore bodies are notable for want of firmness and tenacity. The friable nature of the ore, which renders its mining comparatively easy without blasting, except to fracture large masses, has a counter disadvantage in requiring an expensive system of timbering in order to make extraction safe. Some of the mines are not only exceedingly deep (over three thousand feet), but also of great width. On the 1,550 level of the Consolidated Virginia mine a vein three hundred and thirty feet wide has been worked out. In this and various other mines of the lode veins ranging from sixty-five to two hundred feet in width and consisting of high-grade ore have been completely extracted. The ore of the vein in the Consolidated Virginia, above referred to, furnished an average yield of one hundred and twenty-six dollars of silver and gold to the ton. Such ore is too valuable to be utilized for chamber walls or as principal supports, as is done in most of the mines of the world.

The enormous pressure resulting from the weight of the overlying formation is sustained by an elaborate net-work of costly timbering, which has been admired for its completeness and strength by many skilful mining engineers. Without vast quantities of massive timbers to keep the walls in place, with correspondingly great quantities of wood to generate power for pumping, hoisting, and reduction of ores, the great bulk of the precious metals which the Comstock mines have poured forth would never have been obtainable. To rifle the mineral kingdom of its glittering treasures, man had

first to levy upon the resources of the vegetable kingdom. Without the aid of the forests the wealth of the Comstock would have been as far beyond human reach as the fabulous secrets of the alchemists. These constant drafts of the Comstock mines upon the mountain forests have led to the christening of the lode as "The tomb of the Sierras."

When the mines of the Comstock lode were discovered the surrounding mountains were sparsely covered with a growth of scrubby pines (*Pinus Edulus*), commonly known as pifion or nut-pine, interspersed with a stunted variety of juniper (*Juniperis Virginiana*), generally called cedar. These woods were the most valuable of all for fuel, being hard, resinous, and fine-grained, but were worthless for timbers and lumber, being too small. They supplied the wants of the mines during the prospecting and surface-mining eras and as long as fuel only was wanted. As soon as any considerable depth was reached, the supply was exhausted and the forests of the eastern slope of the Sierra Nevadas, where accessible, were encroached upon. The forest-line of these mountains has receded westward before the woodman's axe until now it is west of the eastern crest of the Sierra range and almost on a line paralleling the western shore of Lake Tahoe, fairly within the limits of the State of California.

Timbers, lumber, and wood are now principally supplied to the Comstock mines from the southern portion of the Lake Tahoe basin, on the California side of the State line, by the Carson and Tahoe Lumber and Flume Company, a corporation entirely independent of the mines. The wood and logs are first transported about twelve miles over the company's railroad to the lake shore at Bijou, the railroad extending, over piles seventeen hundred feet out into the lake, to a depth of water where the steamers and barges can moor alongside of the track. The wood is unloaded from the cars on barges having a carrying capacity of from seventy-five to one hundred and forty cords each. The logs are dumped from the cars into the lake and enclosed in boom timbers forming immense rafts.

The company has two powerful steamers engaged in towing these barges and log rafts to Glenbrook, on the eastern shore of the lake. At this point the logs are sawed into timbers and lumber which, with the wood, are reloaded on cars and transported up a long incline to the summit, over another railroad, about ten miles long, belonging to the company. At the summit these are unloaded and conveyed through a flume for about twelve miles, to the wood and lum-

ber yards at Carson City, Nevada, and from there taken by the Virginia and Truckee R.R. twenty miles to the mines, making a total distance of sixty-five miles from the forest, over two rugged mountain chains. From the forest to the mines the timber, lumber, and wood are necessarily handled thirteen times.

In the operation of its system the Carson and Tahoe Lumber and Fluming Company owns and uses thirty miles of railroad track and switches, two locomotives, forty cars, two steamboats, six barges, and twenty-five miles of flume. This flume is in form of a V, and is provided with all of the improvements which the experience of twenty years in flume transportation have suggested. It has thirty-two to thirty-four-inch sides, a top width of from forty-five to forty-eight inches, and has a diamond in the bottom of from five to seven inches. It was constructed in 1870, has been in use ever since, and has a reliable supply of water from springs and creeks in the high Sierras. It has a carrying capacity of six hundred cords of wood a day, and will transport the heaviest mining timbers as well as lumber and cord-wood.

About fifteen thousand cords of wood are annually supplied from the forests surrounding the headwaters of the Carson river in Alpine county, California, these being floated down the river in drives during the early summer stages of water. About eight thousand cords a year are consumed in the mills along the Carson river, and the remainder is shipped by rail to the Comstock mines.

At present, 120,000 acres of the Sierra Nevada's choicest forests around Lake Tahoe and 75,000 acres around the headwaters of the Carson river have been denuded to operate the mines. When it is considered that this area equals an expanse of land three hundred and five miles long by one mile wide, it will be apprehended that there is good reason for calling the Comstock "The tomb of the Sierras."

Not more than 10,000 acres of timber land and 35,000 acres of woodland are now available to supply the mines. Upon the exhaustion of these it will be necessary to develop the timber regions north of the Truckee river in order to obtain an adequate supply of timbers and wood. This will remove the base of supplies more than one hundred miles from the mines, and will require a heavy expenditure to construct lines of transportation.

None of the Comstock mining companies have ever owned or controlled their timber supplies, but have relied on independent companies or individuals for the same.

From January 1, 1880, to January 1, 1891, in all, 249,756,000 feet of timbers and lumber were shipped to and used in and about the Comstock mines. During the same period 100,776,440 cubic feet of wood were consumed, and to the latter amount should be added 11,264,000 cubic feet consumed by the Carson River mills, auxiliary to the mines, making a total of 875,316 cords. These figures are taken principally from the books of the Virginia and Truckee R.R. Co., and may be relied upon. For the decade commencing January 1, 1870, and ending January 1, 1880, which includes the period of development and working of the bonanzas in the Crown Point, Belcher, Consolidated Virginia, and California mines, the timber, lumber, and wood used cannot be ascertained with exactitude, but a conservative estimate by men most familiar with the facts and with sufficient data upon which to base a nearly correct estimate fixes the figures at 425,000,000 feet of timber and lumber and 268,800,000 cubic feet of wood, to which should be added 10,240,000 cubic feet used in and about the Carson River mills.

In 1870 the timber and lumber sold for $35 per thousand feet at the mines, and wood at $13 per cord, but the prices have gradually fallen since that time, until now timber and lumber are sold at the mines for $22 per thousand feet, and wood for $9 per cord. A conservative and probably underestimate of the average price paid at the mines for timber and lumber since 1870 is $23 per thousand feet, and for wood $10 per cord.

Summarizing the above statistics, the Comstock mines since 1870 have used 674,756,000 feet of timbers and lumber, and have paid therefor, at $23 per thousand feet, $15,519,388.

During the same time the mines and mills have used 391,070,488 cubic feet of wood, costing, at $10 per cord, the sum of $30,553,160; making a grand total cost of $46,072,548. The pumping machinery of the mines was partially stopped in 1882 and entirely shut down in 1884, which accounts for the much smaller quantity of wood used in the last eleven years than was required for the ten years previous thereto.

The consumption of forest products by the mines for the period embraced between the discovery of the Comstock lode and 1870 can hardly be approximated, as there are no data for that time obtainable, but an estimate that the entire cost of timbers, lumber, and wood used in and about the Comstock mines, from the date of their discovery until the present time, is $55,000,000, could hardly exceed the true amount.

With the exception of the shafts and bulkheads, the prevailing system of timbering in the Comstock mines is that devised by Mr. Philip Deidesheimer in 1860 and commonly known as the "Deidesheimer system." It consists of timbers so framed that when a post is set up there is a place on its top for the ends of four caps, and when these are placed in position a mortise is formed into which the end of the next post fits. The same connections are made with each of the four posts, forming a hollow cube, and there is always a place for the caps of the sets to be fitted on any side.

These sets form cribs of timber six feet square, strengthened by timbers connecting opposite corners in the manner of diagonals of squares. These cribs, when completed, make convenient places in which to stow away waste rock, and make the whole almost as firm as the original material. These sets are as compact as the cells of a honeycomb, to which they bear a striking resemblance except in figure, and by repetition may be extended in all directions to any distance that may be required. This system of timbering exemplifies the truth of the old adage that "Necessity is the mother of invention," for without it the Comstock miners could do nothing, but with it, the mines can be safely worked to any depth, width, or length.

The seemingly endless labyrinths of timbers in the Comstock mines when ignited and beyond control make a subterranean fire which burns and smolders for years. Many lives have been lost in the mines by reason of these fires, but none have been recorded as having been lost because of any inherent defect in the timbers or system of timbering.

A large proportion of the timber and lumber used in these mines has been in the constructing of shafts and bulkheads. Many of these shafts are from two thousand to more than three thousand feet deep, and are completely encased in timbers. In the Consolidated Virginia mine there is one bulkhead three hundred feet long, two hundred feet high, and eighty feet wide, containing 57,650,000 feet of timbers. Another bulkhead in the same mine is one hundred and fifty feet long, one hundred feet high, and fifty feet wide, and contains 9,000,000 feet of timbers. There are other bulkheads of smaller dimensions, but containing in the aggregate vast amounts of heavy timbers.

The sizes of the timbers used in these mines vary from the huge pieces sixteen inches square and twenty-four feet long to the smaller pieces eight inches square, used in cribbing.

The species used consist of yellow pine (*Pinus poderosa*), fir,

(*Picea magnifica*), and cedar (*Thuya gigantea*), of which the latter is found in such small quantities as to be hardly worth considering. Fully two-thirds used is yellow pine, about one-third fir, and less than one per cent. is cedar.

In a comparison of these woods, in point of durability, red fir would rank at one hundred per cent., yellow pine at ninety per cent., and white fir at sixty-five per cent. In a comparison in point of strength, red fir would rank at one hundred per cent., yellow pine at ninety per cent., and white fir at about ninety per cent. In the generation of heat, they would rank in the order of yellow pine, red fir, and white fir. Yellow pine is a favorite timber with mine carpenters on account of its exactitude in joining. Cedar is inferior to no known timber, not even excepting red wood, for its lasting qualities under ground. Yellow pine has been taken from the lower levels of these mines so compacted by the enormous pressure it has withstood as to have a density and weight exceeding *lignum vitæ*, and has been made into handsome paper weights and other ornaments.

None of the timbers in the Comstock mines have yet badly decayed and their life there cannot be accurately determined. The heat and the vapors of the mines, surcharged with mineral matter, appear to have a decidedly preservative effect upon the timbers.

Nearly or quite all of the timber cut for these mines is felled during the winter and spring months; it is flumed during the summer and autumn months, but the timber and lumber are in the water only during their passage through the flume—not more than an hour and fifteen minutes. Upon being discharged at the mouth of the flume in the yards, the timber is at once piled up in such a way as to prevent warping and cracking and so that the air can circulate freely between each piece. The wood remains until shipped as it is discharged by the flume. As it is built up almost to a level with the flume, the latter is extended so that the wood is piled up by the water in long pyramidal masses about thirty feet wide at the bottom, ten feet wide at the top, and about twenty feet high; being thoroughly wet when discharged by the flume and drenched as piled, it remains more or less wet for several months and sometimes partially sours. For this reason, flume wood will not generate quite as much heat as will wood which has never been in the water. The effect of the water on timbers and lumber, when handled as herein described, is hardly appreciable.

The area upon which the forest has been cut off to supply the

mines is now growing up, principally in pine, but the reproductive growth is so slow that it will require more than a century for the trees to attain a size sufficient to furnish the timbers required by the mines. The new growth is very thick, but as it becomes large the economy of nature, "the survival of the fittest," will kill out the weaklings and leave the stronger young trees at a proper distance apart. On some of the lower slopes of the mountains where the new growth is over twenty years old there are few trees ten inches in diameter, and the average diameter will not exceed six inches. In the Tahoe Basin, which has been cut over principally within the last ten years, the reproductive growth is about five feet high and will average about four inches in diameter. It is especially noticeable that in the Sierra Nevadas fir predominates on the north slopes where the snow remains the longest and the sun shines the least. On the other slopes pine largely predominates. This indicates that the Sierra fir thrives in a colder climate than is congenial to pine. A further fact is noticeable, that the reproductive growth contains a much larger percentage of pine and a less percentage of fir than the original growth contained. This is satisfactorily accounted for by reason of the sun reaching the ground after the primeval forest is cut off. As the new growth becomes larger and the ground is shaded a larger number of young pines than firs die, but a careful observation leads to the conclusion that when the trees become large enough for use the percentage of pine will exceed and that of the fir be less than in the primeval forest.

The present condition of the mines seems to indicate that the timber available will be adequate to their demands, but if extensive ore bodies should be discovered in the lode, or additional lodes within fifty miles of the Comstock, an enormous expenditure must be incurred to supply necessary forest products.

THE EFFECTIVE METHOD OF ADVANCING FORESTRY INTERESTS.

By Herbert Welsh, Philadelphia, Pennsylvania.

[Read at World's Fair Congress, October, 1893.]

The swiftness of the development of our country, owing to the vastness of its resources and to the enormous influx of foreigners, the stimulus that our free institutions give to every department of our life, result in confronting us with a multitude of problems—moral, social, economic, political—which, for their solution, tax the

thought and resources of the individual citizen to a greater degree than is the case in any other country. The privileges of our unusual advantages as a people entail a correspondingly weighty obligation. If the vast resources of the republic are to be preserved unimpaired for the future it will not be by laudations of the past, or by present devotion to the acquisition of individual riches, but by continuous patriotic gifts of thought, time, and effort to the best development by each citizen. The fundamental principle of advance under popular government is the responsibility of the individual for the good of the whole. Such considerations as these are necessary in the solution of our forestry question.

A small group of experts for years have been warning us of the danger of the situation—of the economic loss should the waste of our forest resources be unchecked. If wise legislation does not step in to protect the forests which supply the lumber market, conserve the streams and arable soils, an impoverishment of one of the greatest sources of wealth of the nation will ensue. It is a situation calling for prompt action by the Federal Government and by the individual States, but such action cannot be hoped for until the laborious preliminary work of popular agitation has been accomplished.

It must not be forgotten that the best legislation does not originate with legislators, but is born of popular demands. But how can the popular mind be aroused to demand a reform of this character? It is only through the systematic reiteration of the facts in the ears of the legislator by the tongues of his constituents. But this can only be accomplished through permanent organization, for it takes numberless blows to set swinging the pendulum of a popular demand for reform. The experiences of the Pennsylvania Forestry Association will illustrate this thought, and may be of service to forestry workers elsewhere.

The work of this organization began in the heads and hearts of a very few intelligent and public-spirited women, who were helped and stimulated to persevere by the encouraging advice of a devoted forestry worker, Mr. J. B. Harrison. Then came into the field an added number of men and women of the class most necessary to such movements—men and women who, while not pretending to exact scientific knowledge of the subject, have a fair understanding of it, are profoundly impressed with its importance, and are willing to lend a helping hand. Then came naturally the organization of a forestry association, to be followed by much faithful individual and associated work. This included a very considerable use of the

press, the publication of "Forest Leaves," the printing of many leaflets, the holding of public meetings in various parts of the State, especially in the neighborhood of Philadelphia, and ineffectual attempts to secure the passage of a bill through the State legislature creating a forestry commission.

Good preliminary work was done by the association, but much better work was needed. It was necessary to arouse the people representing the various interests in the State to the real necessity for action, before the legislature could be moved to pass the bill. What was needed was a general secretary of full experience and the best attainments—a man armed with both the knowledge and skill that would enable him to represent the cause with convincing force to the people of the State. This want was finally relieved by the appointment of Dr. J. T. Rothrock, the well-known botanist, as secretary, with the understanding that he would devote his entire time to the work. No more fortunate appointment could have been made or policy decided upon. Dr. Rothrock brought the best possible equipment to the work, and devoted himself to it with skill and assiduity. During the winter months he visited most of the counties of the State, giving illustrated public lectures, speaking before county societies, talking with numerous constituents and their legislators in so convincing a manner that before the close of the session the forestry bill had become a law. Not only that, but as a convincing proof of the sincerity of the governor's desire for the success of the work of the commission, Dr. Rothrock was appointed its botanist, and has spent the summer in the field actively prosecuting its work.

The forestry cause is one of far-reaching and profound importance to the country. A clear statement of its facts and arguments cannot be brought effectively to the popular mind without popular organizations in the various States—organizations which shall not be content with desultory work, but will be satisfied with nothing less than putting into the field a man of large calibre who shall give his entire time to the prosecution of the work, and whose efforts shall be supported morally and financially by the association which he represents. Experience teaches that there is no way so effective for prosecuting reform work as that of making strong the hands of an efficient man. It is an expensive method, but the only one. In no way can money be better spent by public-spirited men and women who long for the increase of national wisdom and labor for the promotion of the general welfare.